

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Iouri Kalinitchenko

Serial No.: *To be assigned*

Filed: March 29, 2002

Title: MASS SPECTROMETER INCLUDING
A QUADRUPOLE MASS
ANALYSER ARRANGEMENTExaminer: *To be assigned*Art Unit: *To be assigned*

I, Debbie Kus, hereby certify that on March 29, 2002, this correspondence is being deposited with the United States Postal Service as Express mail no EV 094 354 747 US, in an envelope addressed to Box PATENT APPLICATION, Assistant Commissioner for Patents, Washington, D.C. 20231

Debbie Kus 3/29/02
Signature Date Signed

Box PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to examination on the merit, please amend the referenced application as follows:

IN THE CLAIMS

Claim 3: please change the dependency to claim 1 only.

Claim 5: please change the dependency to claim 1 only.

Claim 9: please change the dependency to claim 1 only.

Claim 10: please change the dependency to claim 1 only.

Claim 11: please change the dependency to claim 1 only.

Claim 14: please change the dependency to claim 1 only.

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REMARKS

This patent application is submitted for filing in the US PTO as a continuation of international application PCT/AU01/01024 under 35 USC 111(a) and claiming the priority under International Convention.

The claims 3, 5, 9, 10, 11 and 14 has been amended to avoid multiple dependency. No new matter has been introduced. Three substituted pages are enclosed herewith.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version with Markings to Show Changes Made**".

Consideration of the preliminary amendment is respectfully requested.

Respectfully submitted,



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Dated: March 29, 2002

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

WHAT IS CLAIMED IS

- 1 A mass spectrometer including,
a source for producing particles including ions representative of chemical
5 elements in a sample together with neutral particles and photons,
an ion optics system contained in a first vacuum region for receiving
particles from the source, the ion optics system including
at least one first electrode for establishing an electrostatic field for
directing a beam of said ions in a first direction from the source and at
10 least one second electrode for establishing an electrostatic field for
diverting the beam of ions from the first direction through an angle
whereby neutral particles and photons emanating from the source
continue in the first direction and are separated from the beam of ions,
a quadrupole mass analyser arrangement contained in a second
15 vacuum region and including
a set of quadrupole fringe electrodes for receiving the beam of ions, and
a linear quadrupole mass analyser for receiving ions directly from the set
of quadrupole fringe electrodes, and
an ion detector also contained in the second vacuum region for receiving
20 ions from the linear quadrupole mass analyser,
wherein the set of quadrupole fringe electrodes are configured to divert
the ions prior to their passage into the linear quadrupole mass analyser and to
shield the linear quadrupole mass analyser entrance.
- 25 2. A mass spectrometer as claimed in claim 1 wherein the at least one
second electrode is for establishing an electrostatic field for diverting the beam
of ions from the first direction through an angle and in a second direction, and
the set of quadrupole fringe electrodes of the quadrupole mass analyser
arrangement receive the beam of ions in the second direction and shield the
30 linear quadrupole mass analyser entrance as viewed in the second direction.
3. A mass spectrometer as claimed in claim 1 for claim 2 wherein the ion
optics system includes a first set of electrodes for establishing the electrostatic
field for directing the beam of ions in the first direction, and a second set of

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electrodes for establishing the electrostatic field for diverting the beam of ions from the first direction through said angle.

4. A mass spectrometer as claimed in claim 2 wherein at least one or more
5 electrodes of the ion optics system are for establishing a reflecting electrostatic field for diverting the beam of ions from the first direction through said angle and in the second direction.
- 10 5. A mass spectrometer as claimed in any one of claims 1 to 4 wherein the electrodes of the set of quadrupole fringe electrodes are elongate and curved to thereby define a curved path to divert the ions prior to their passage into the linear quadrupole mass analyser.
- 15 6. A mass spectrometer as claimed in claim 5 wherein the electrodes of the set of quadrupole fringe electrodes are curved such that the ions exit the set of quadrupole fringe electrodes generally in the same direction as they enter the set of quadrupole fringe electrodes, whereby an entrance end and an exit end of the set of quadrupole fringe electrodes are substantially parallel but not co-linear.
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7. A mass spectrometer as claimed in claim 5 wherein the electrodes of the set of quadrupole fringe electrodes are doubly curved such that the ions exit the set of quadrupole fringe electrodes generally in the same direction as they enter, whereby an entrance end and an exit end of the set of quadrupole fringe
25 electrodes are substantially parallel and co-linear.
8. A mass spectrometer as claimed in claim 5 wherein the electrodes of the set of quadrupole fringe electrodes are curved such that the ions exit the set of quadrupole fringe electrodes in a direction generally at 90° to the direction in
30 which they enter.
9. A mass spectrometer as claimed in any one of claims 1 to 4 wherein the electrodes of the set of quadrupole fringe electrodes are elongate and straight, and are tilted relative to an entry direction for the ions into the set of quadrupole

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fringe electrodes to thereby divert the ions from that direction prior to their passage into the liner quadrupole mass analyser.

10. A mass spectrometer as claimed in ~~any one of~~ claims 1 to 9 wherein the
5 set of quadrupole fringe electrodes are configured such that as viewed in an entry direction for the ions into the set of quadrupole fringe electrodes, the electrodes of the set at least cover and thereby shield the linear quadrupole mass analyser entrance and thereby also shield the detector.

10 . 11. A mass spectrometer as claimed in ~~any one of~~ claims 1 to 10 wherein the angle through which the beam of ions is diverted from the first direction is at least 10^0 .

12. A mass spectrometer as claimed in claim 2 wherein the angle between
15 the first direction and the second direction is substantial, being greater than 10^0 .

13. A mass spectrometer as claimed in claim 12 wherein the substantial angle is about 90^0 .

20 14. A mass spectrometer as claimed in ~~any one of~~ claims 1 to 13 wherein the source for producing particles including ions representative of chemical elements in a sample together with neutral particles and photons is an inductively coupled plasma source.

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WHAT IS CLAIMED IS

1. A mass spectrometer including,
a source for producing particles including ions representative of chemical
5 elements in a sample together with neutral particles and photons,
an ion optics system contained in a first vacuum region for receiving
particles from the source, the ion optics system including
at least one first electrode for establishing an electrostatic field for
directing a beam of said ions in a first direction from the source and at
10 least one second electrode for establishing an electrostatic field for
diverting the beam of ions from the first direction through an angle
whereby neutral particles and photons emanating from the source
continue in the first direction and are separated from the beam of ions,
a quadrupole mass analyser arrangement contained in a second
15 vacuum region and including
a set of quadrupole fringe electrodes for receiving the beam of ions, and
a linear quadrupole mass analyser for receiving ions directly from the set
of quadrupole fringe electrodes, and
an ion detector also contained in the second vacuum region for receiving
20 ions from the linear quadrupole mass analyser,
wherein the set of quadrupole fringe electrodes are configured to divert
the ions prior to their passage into the linear quadrupole mass analyser and to
shield the linear quadrupole mass analyser entrance.
- 25 2. A mass spectrometer as claimed in claim 1 wherein the at least one
second electrode is for establishing an electrostatic field for diverting the beam
of ions from the first direction through an angle and in a second direction, and
the set of quadrupole fringe electrodes of the quadrupole mass analyser
arrangement receive the beam of ions in the second direction and shield the
30 linear quadrupole mass analyser entrance as viewed in the second direction.
3. A mass spectrometer as claimed in claim 1 wherein the ion
optics system includes a first set of electrodes for establishing the electrostatic
field for directing the beam of ions in the first direction, and a second set of

electrodes for establishing the electrostatic field for diverting the beam of ions from the first direction through said angle.

5. A mass spectrometer as claimed in claim 1 wherein the electrodes of the set of quadrupole fringe electrodes are elongate and curved to thereby define a curved path to divert the ions prior to their passage into the linear quadrupole mass analyser.

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7. A mass spectrometer as claimed in claim 5 wherein the electrodes of the set of quadrupole fringe electrodes are doubly curved such that the ions exit the set of quadrupole fringe electrodes generally in the same direction as they enter, whereby an entrance end and an exit end of the set of quadrupole fringe electrodes are substantially parallel and co-linear.

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9. A mass spectrometer as claimed in claim 1 wherein the electrodes of the set of quadrupole fringe electrodes are elongate and straight, and are tilted relative to an entry direction for the ions into the set of quadrupole

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fringe electrodes to thereby divert the ions from that direction prior to their passage into the linear quadrupole mass analyser.

10. A mass spectrometer as claimed in claim 1 wherein the
5 set of quadrupole fringe electrodes are configured such that as viewed in an
entry direction for the ions into the set of quadrupole fringe electrodes, the
electrodes of the set at least cover and thereby shield the linear quadrupole
mass analyser entrance and thereby also shield the detector.

10 . 11. A mass spectrometer as claimed in claim 1 wherein the angle through which the beam of ions is diverted from the first direction is at least 10^0 .

12. A mass spectrometer as claimed in claim 2 wherein the angle between
15 the first direction and the second direction is substantial, being greater than 10° .

13. A mass spectrometer as claimed in claim 12 wherein the substantial angle is about 90° .

14. A mass spectrometer as claimed in claim 1 wherein the source for producing particles including ions representative of chemical elements in a sample together with neutral particles and photons is an inductively coupled plasma source.